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(54) NON-ALKALI DECORATING TYPE LUBRICATING RESIN TREATED STEEL PLATE AND MANUFACTURE THEREOF**(57)Abstract:**

PROBLEM TO BE SOLVED: To realize the possession of an excellent primary rust-proofness without the application of a rust resisting oil and of an excellent press-workability without the application of a press oil, excellent weldability, and the possession of an enough adhesion of overcoating film even without zinc phosphate film and of a water-resistant secondary adhesion.

SOLUTION: This steel plate has a film, which consists of an urethane-based resin having Tg of 40-100°C and the acid value of 10-50, and a polyethylene wax having Ts of 90-130°C, the coating build-up of which is 0.5-3g/m², the solid ratio of urethane/polyethylene of which is 97/3-80/20 and the film-forming percentage defined by the following formula of which is 70-100%. The formula: the film-forming percentage (%) of a lubricating treated film = [(the number of particles in an air dried film - the number of particles in an baked film)/the number of particles in the air dried film] × 100, in the formula, the number of particles is the number per 1μm × 1μm of urethane-based resin particles and of polyethylene wax particles, which respectively are clearly confirmed when the rupture cross-section of the lubricating film on the surface of a steel plate under the state that the resin-treated steel plate is cooled in liquid nitrogen and then brittly fractured by abruptly apply a force is observed with an electron microscope at 10,000 power.

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CLAIMS

[Claim(s)]

[Claim 1] To one side or both sides of hot-rolling or a cold rolled sheet steel, the acid number at 40 degrees C - 100 degrees C The urethane system resin of 10-50, [a glass transition point (Tg)] Softening temperature (Ts) consists of a polyethylene wax which is 90 degrees C - 130 degrees C. the solid-content ratio of an urethane system resin / polyethylene wax by the weight ratio by 97 / 3 - 80/20 It is the coat whose rate of film formation defined by the [following A] formula is 70% - 100% at coating weight 0.5 g/m² - 3.0 g/m² Non-alkali removing-of-coating type lubricous resin-treatment steel plate which it has.

Rate [of a lubricating-treatment coat] of film formation (%) = [(particle number of particle number-printing paint film of air-drying coat)particle number of /air-drying coat] x100 [A] Formula (in the above-mentioned [A] formula with a particle number) 1micrometerx of the urethane system resin particle which applies and carries out the brittle fracture of the force rapidly after cooling a resin-treatment steel plate in liquid nitrogen, observes the lubricous coat fracture surface on the front face of a steel plate by 10,000 times with an electron microscope, and can be checked clearly, and a polyethylene wax particle -- it is a number per micrometer

[Claim 2] It is the manufacture method of a non-alkali removing-of-coating type lubricous resin-treatment steel plate according to claim 1. the acid number at 40 degrees C - 100 degrees C by 0.01 micrometers - 0.2 micrometers The drainage system emulsion of the urethane system resin of 10-50, [a particle diameter] [a glass transition point (Tg)] The manufacture method of a non-[which applies and prints the drainage system emulsion coating which comes to mix the drainage system emulsion of the polyethylene wax whose softening temperature (Ts) is 90 degrees C - 130 degrees C by 0.01 micrometers - 0.2 micrometers] alkali removing-of-coating type lubricous [a particle diameter] resin-treatment steel plate.

[Claim 3] The non-alkali removing-of-coating type lubricous resin-treatment steel plate characterized by providing the following. For a glass transition point (Tg), to one side or both sides of hot-rolling or a cold rolled sheet steel, the acid number is [a particle diameter] the drainage system emulsion of the urethane system resin of 10-50 at 40 degrees C - 100 degrees C in 0.01 micrometers - 0.2 micrometers. The coating weight on which a particle diameter applies and comes to print the drainage system emulsion coating which comes to mix the drainage system emulsion of the polyethylene wax whose softening temperature (Ts) is 90 degrees C - 130 degrees C by 0.01 micrometers - 0.2 micrometers is 0.5 g/m² - 3.0 g/m². Lubricating-treatment coat whose rate of film formation as which the solid-content ratio of an urethane system resin / polyethylene wax was defined by the [following A] formula by the weight ratio 97 / 3 - 80/20 is 70% - 100%.

Rate [of a lubricating-treatment coat] of film formation (%) = [(particle number of particle number-printing paint film of air-drying coat)particle number of /air-drying coat] x100 [A] Formula (in the above-mentioned [A] formula with a particle number) 1micrometerx of the urethane system resin particle which applies and carries out the brittle fracture of the force rapidly after cooling a resin-treatment steel plate in liquid nitrogen, observes the lubricous coat fracture surface on the front face of a steel plate by 10,000 times with an electron microscope, and can be checked clearly, and a polyethylene wax particle -- it is a number per micrometer

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention belongs to the technical field of a resin-treatment steel plate. Since weldability at the time of being able to skip the alkaline-degreasing process currently carried out after the press, and this joining mold goods, since press working of sheet metal can be carried out more to a detail by non-oiling is not spoiled and it is moreover a non-alkali removing-of-coating type coat, Exist in the steel plate front face, without a resin-treatment coat dissolving, even if it passes through the oiling -> alkaline-degreasing process currently performed from the former, and adhere, and although there is nothing, chemical-conversion coats, such as phosphoric-acid zinc It has the adhesion and secondary deck-watertight-luminaire adhesion of finishing paint films, such as electropainting and electrostatic powder coating. Furthermore, it is related with hot-rolling which comes to have the non-alkali removing-of-coating type lubricous resin treatment excellent in non-oiling rust prevention nature, non-oiling press-working-of-sheet-metal nature, finishing paint film adhesion, secondary deck-watertight-luminaire adhesion, and weldability which is excellent also in the weldability at the time of joining a press-working-of-sheet-metal object or a cold rolled sheet steel, and its manufacture method.

[0002] If printing is fully performed at an elevated temperature over many hours using the paint of a general organic-solvent system, it is comparatively easy to discover many properties, such as primary rust prevention nature and press-working-of-sheet-metal nature. However, in order that the method of painting hot-rolling and a cold rolled sheet steel with another line may cause the manufacturing-cost rise of a resin-treatment steel plate, it wants not to pretreat in the very short space by the side of CAL (continuous-annealing line) appearance, and to perform paint and printing also by the case of a cold rolled sheet steel, immediately after a pickling process, by the case of a hot rolled sheet steel. And since he wants to make a paint facility and incidental facilities cheap, it is the baking furnace of about [5-10m] short length, and it is necessary to make the low steam of energy cost into a heat source, and a cheap non-explosion protection type printing furnace needs to perform paint printing. In order to fill the demand on such a production line, it is desirable to burn on conditions from which the attainment board temperature of 5 - 15 seconds after becomes 50-70 degrees C, without pretreating. Moreover, this invention realizes the lubricous resin-treatment steel plate with which the above-mentioned demand in a production line is given possible, and it is satisfied of the above-mentioned property by using predetermined drainage system emulsion coating.

[0003]

[Description of the Prior Art] Development of the lubricative resin steel plate with which it has the primary rust prevention nature which was excellent even if it did not apply a slushing oil to the front face, and it has press-working-of-sheet-metal nature even if it does not apply a press oil, it moreover excels also in weldability, removing of coating is not further carried out even if it passes through an alkaline-degreasing process after that, with a phosphoric acid zinc coat does not generate, but ** also has sufficient finishing paint film adhesion is demanded from the former. However, the present condition is that technology as shown below is proposed as similar technology which technology which solves such all properties simultaneously is not yet realized, but contains the part.

[0004] For example, water solubility and/or a water-dispersion resin are applied to a cold-rolled-sheet-steel front face, and the lubricating-treatment metal plate for press working of sheet metal which has the lubricous coat makes solid lubricant powdered, and applied and the non-dried coat front face was made to dry in ordinary temperature is indicated by JP,53-44468,A. According to this lubricating-treatment metal plate, although the press-working-of-sheet-metal nature and weldability in non-oiling are obtained, this coat system has alkali removing-of-coating nature, and its density of hydrophilic groups, such as a carboxyl group and a hydroxyl group, is high, it is rich in a hydrophilic property, and inferior to the rust prevention nature in non-oiling. Furthermore, two steps of manufacturing processes (a resin application -> solid lubricant application, dryness) are needed, and there is a difficulty also in respect of productivity.

[0005] Moreover, the rustproof lubricating-treatment steel plate which makes front faces, such as hot-rolling, cold-rolling, and a surface treated steel sheet, come to cover the constituent which consists of the alkaline-earth-metal salt of an oxidation wax, a rust-proofer, and a surfactant is indicated by JP,54-69662,A. Although press-working-of-sheet-metal nature is made to discover centering on an oxidation wax in the case of this rustproof lubricating-treatment steel plate, if it is not a mixed coat with a resin, a coat degree of hardness is too low, although it has lubricity, its ratio contact of metal mold and a material is large, and the press-working-of-sheet-metal nature in non-oiling is inferior. Moreover, although the oxidation wax and the surfactant are used together for the purpose of improvement in the lubricity of a coat, or emulsifiability, since it is not a non-alkali removing-of-coating type, it is inferior to the rust prevention nature in non-oiling. Furthermore, although the

rustproof effect of a rust-proofer is accepted, since the rust prevention nature in non-oiling of the organic coat used as the base is very inferior, an effect is small by a setoff.

[0006] The high corrosion resistance surface treated steel sheet which made the coat containing an acrylic emulsion, a chromate, and a silica sol form in front faces, such as cold-rolling and a surface treated steel sheet, is indicated by JP,61-23767,A. In the case of this high corrosion resistance surface treated steel sheet, depending on the annealing conditions of coat formation, since there is very much water-soluble hexavalent chromium, the elution speed is too quick, and the rust prevention nature in non-oiling is poor. Moreover, it is industrially disadvantageous, if there are many chromium elution volumes to the inside of an alkaline-degreasing tub and they take the influence on circumference environment into consideration.

[0007] After forming a chromate film on the surface of a cold rolled sheet steel, the art which applies a water soluble resin or an emulsion is indicated by JP,62-77498,A. Moreover, in this art, a rust preventive pigment and a silica sol are added in the aforementioned water soluble resin if needed. However, in the case of this art, after preparing a chromate film, about a water soluble resin or an emulsion, coat formation is carried out and a difficulty is in productivity like an application and the example indicated by above-mentioned JP,53-44468,A. Moreover, although generation of the basic zinc chloride which suppresses corrosion is urged to addition of a silica sol and it brings about corrosion resistance improvement when making a zinc system plating steel plate into a base material, when making hot-rolling and a cold rolled sheet steel into a base material, it will reduce the rust prevention nature in non-oiling with the hydrophilic property of a silica sol conversely.

[0008] Furthermore, the steel plate which made press-forming nature, removing-of-coating nature, and rust prevention nature improve is indicated by JP,2-310384,A by carrying out application dryness of the water-soluble liquid which consists of a polyethylene oxide, a water-soluble rust-proofer, several sorts of other colloid, etc. on the surface of a steel plate. However, the rust prevention nature in non-oiling of this steel plate is not enough too, and, moreover, it does not have non-alkali removing-of-coating nature.

[0009]

[Problem(s) to be Solved by the Invention] The resin-treatment steel plate which the purpose of this invention has in solving the trouble of the aforementioned conventional technology, and fulfills many above-mentioned properties of all suitably, Namely, it has the primary rust prevention nature which was excellent even if it did not apply a slushing oil to the front face. And have the press-working-of-sheet-metal nature which was excellent even if it did not apply a press oil, and it excels also in weldability. and -- even if it passes through an alkaline-degreasing process after that -- removing of coating -- not carrying out -- this -- with, even if there is no phosphoric acid zinc coat, it is in offering the lubricous resin-treatment steel plate which has sufficient finishing paint film adhesion and secondary deck-watertight-luminaire adhesion

[0010]

[Means for Solving the Problem] this invention person etc. repeated research wholeheartedly, in order to realize the resin-treatment steel plate with which are satisfied of many above-mentioned properties of all. Consequently, it found out that the view for having the rust prevention nature in non-oiling was important, and the following knowledge was acquired based on this also especially in inside.

[0011] First, in order to have the rust prevention nature in non-oiling, at the time of the wettability of a base material and a paint film, adhesion, especially lubrication, improvement in the adhesion force is effective and, for that, the method using the drainage system emulsion which consists of a urethane-resin system is effective. That is, it is because the high urethane bond of hydrogen bond ability has a big effect to raise the humid adhesion force. Moreover, it is also effective on the rustproof disposition in non-oiling to suppress transparency of salt water. The method of heightening the cohesive force between molecules for that purpose, and using the above-mentioned urethane bond also from this viewpoint is effective. Furthermore, rust prevention nature improves, so that the rate of film formation which is later mentioned also by the coat of the same composition in addition to both the aforementioned knowledge is high. The technique of making small the particle diameter of selection of printing conditions, a resin, or a wax emulsion for that purpose is also effective.

[0012] this invention is accomplished based on the above-mentioned knowledge. the acid number at 40 degrees C - 100 degrees C to one side or both sides of hot-rolling or a cold rolled sheet steel The urethane system resin of 10-50, [a glass transition point (Tg)] Softening temperature (Ts) consists of a polyethylene wax which is 90 degrees C - 130 degrees C. the solid-content ratio of an urethane system resin / polyethylene wax by the weight ratio by 97 / 3 - 80/20 It is the coat whose rate of film formation defined by the [following A] formula is 70% - 100% at coating weight 0.5 g/m² - 3.0 g/m² The non-alkali removing-of-coating type lubricous resin-treatment steel plate which it has is offered.

Rate [of a lubricating-treatment coat] of film formation (%) = [(particle number of particle number-printing paint film of air-drying coat)particle number of /air-drying coat] x100 [A] Formula (in the above-mentioned [A] formula with a particle number) 1micrometerx of the urethane system resin particle which applies and carries out the brittle fracture of the force rapidly after cooling a resin-treatment steel plate in liquid nitrogen, observes the lubricous coat fracture surface on the front face of a steel plate by 10,000 times with an electron microscope, and can be checked clearly, and a polyethylene wax particle -- it is a number per micrometer

[0013] Moreover, the manufacture method of this invention is the manufacture method of the non-alkali removing-of-coating type lubricous resin-treatment steel plate of the aforementioned this invention. The acid number at 40 degrees C - 100 degrees C by 0.01 micrometers - 0.2 micrometers The drainage system emulsion of the urethane system resin of 10-50, [a particle diameter] [a glass transition point (Tg)] By 0.01 micrometers - 0.2 micrometers, a particle diameter applies the drainage system emulsion coating which comes to mix the drainage system emulsion of the polyethylene wax whose softening

temperature (Ts) is 90 degrees C - 130 degrees C, and offers the manufacture method of the non-alkali removing-of-coating type lubricous resin-treatment steel plate to print.

[0014] furthermore, another mode of this invention -- one side or both sides of hot-rolling or a cold rolled sheet steel -- the acid number with the drainage system emulsion of the urethane system resin of 10-50 at 40 degrees C - 100 degrees C by 0.01 micrometers - 0.2 micrometers [a particle diameter] [a glass transition point (Tg)] A particle diameter applies the drainage system emulsion coating which comes to mix the drainage system emulsion of the polyethylene wax whose softening temperature (Ts) is 90 degrees C - 130 degrees C by 0.01 micrometers - 0.2 micrometers, the coating weight which it comes to print -- 0.5 g/m² - 3.0 g/m² The non-alkali removing-of-coating type lubricous resin-treatment steel plate which has the lubricating-treatment coat whose rate of film formation as which the solid-content ratio of an urethane system resin / polyethylene wax was defined by the [following A] formula by the weight ratio 97 / 3 - 80/20 is 70% - 100% is offered. Rate [of a lubricating-treatment coat] of film formation (%) = [(particle number of particle number-printing paint film of air-drying coat) / (particle number of /air-drying coat)] x100 [A] Formula (in the above-mentioned [A] formula with a particle number) 1micrometerx of the urethane system resin particle which applies and carries out the brittle fracture of the force rapidly after cooling a resin-treatment steel plate in liquid nitrogen, observes the lubricous coat fracture surface on the front face of a steel plate by 10,000 times with an electron microscope, and can be checked clearly, and a polyethylene wax particle -- it is a number per micrometer

[0015]

[Embodiments of the Invention] Hereafter, the non-alkali removing-of-coating type lubricous resin-treatment steel plate (it considers as a resin-treatment steel plate hereafter) of this invention is explained in detail.

[0016] As a base material of the resin-treatment steel plate of this invention, various use of a general hot rolled sheet steel and a general cold rolled sheet steel is possible. However, the property level of press-working-of-sheet-metal nature or weldability mentioned later cannot be overemphasized by changing with steel plate thickness, the mechanical properties of a steel plate, etc.

[0017] The resin-treatment steel plate of this invention uses for one side or both sides of these steel plates the drainage system emulsion which Tg is 40 degrees C - 100 degrees C, and the lubricous resin coat which the acid number becomes from the urethane system resin of 10-50 and the polyethylene wax whose Ts is 90 degrees C - 130 degrees C is formed, and comes to mix the drainage system emulsion of an urethane system resin, and the drainage system emulsion of a polyethylene system wax preferably.

[0018] In the resin-treatment steel plate of this invention, the reason using an urethane system resin is for raising the rust prevention nature in non-oiling. As mentioned above, in order to raise rust prevention nature, improvement in the adhesion force is effective at the time of the wettability of a base material and a paint film and adhesion, especially humidity. Since it has an effect with big having the high urethane bond of hydrogen bond capacity for raising the humid adhesion force, the resin of an urethane system is used in this invention. Moreover, it is also effective to suppress transparency of salt water and, for that, it is necessary to heighten the cohesive force between molecules. It is effective like the above also from this viewpoint to use a urethane bond.

[0019] In this invention, the urethane system resin whose Tg (glass transition point) is 40 degrees C - 100 degrees C is used. In case continuation press working of sheet metal of the steel plate is carried out by non-oiling, the temperature up of the metal mold is carried out by frictional heating with metal mold and a steel plate, or plastic deformation generation of heat of a steel plate. Here, although this exoergic temperature has various possibility according to press conditions, if the range of 40 degrees C - 100 degrees C is considered on the average, it will be thought that it can respond mostly. If this thing is taken into consideration, 40 degrees C - 100 degrees C, then good press-working-of-sheet-metal nature can be obtained for Tg of an urethane system resin. that is, the metal mold according [when Tg is less than 40 degrees C, under press environment, a coat becomes soft too much, and] to deformation and ablation of a coat -- the rate of metal-to-metal contact between /steel plates increases, coefficient of friction rises, and press-working-of-sheet-metal nature falls On the other hand, in 100-degree-C **, the flexibility of the resin under press environment runs short, ablation of a coat etc. becomes intense too, and the same problem as the above occurs. In addition, the range of Tg of an urethane system resin is 60 degrees C - 90 degrees C preferably.

[0020] Moreover, in this invention, the acid number (mg of KOH required to neutralize the free fatty acid contained in 1g of resins number) uses the urethane system resin of 10-50. The acid number and alkali removing-of-coating nature are fundamentally in direct proportion. Therefore, when the acid number is less than ten, the hydrophilic property of an urethane system resin falls, even if it uses together and carries out moisture powder of the surfactant, sufficient distribution cannot be performed, but the particle diameter of a resin changes too much greatly, or the fall of the adhesion and secondary deck-watertight-luminaire adhesion of a finishing paint film occurs for the bleeding to the front face of a surfactant. On the contrary, in order to carry out removing of coating when alkali removing-of-coating nature becomes high, and the acid number exceeds 50 so that the acid number became high, and it passes through an alkaline-degreasing process, even if it is the case where it passes through what manufacturing process, the purpose of this invention of realizing the adhesion and secondary deck-watertight-luminaire adhesion of a finishing paint film which were excellent without adhesion of a chemical-conversion coat cannot be attained, but moreover, the hydrophilic property of a coat is too high and the fall of non-oiling rust prevention nature is also seen. In addition, the acid numbers of a urethane resin are 20-40 preferably. [0021] in this invention, conditions, such as Above Tg and the acid number, are fulfilled as an urethane system resin -- well-known and various use of a commercial thing are possible Specifically, it is HYDRAN HW-311 by Dainippon Ink &

Chemicals, Inc. as one example. Various kinds of things of HW-317 grade are mentioned.

[0022] In this invention, the drainage system emulsion of such an urethane system resin is used preferably. Various use is possible for well-known methods, such as the method of especially limitation not having in the manufacture method of the drainage system emulsion of an urethane system resin, mixing a urethane resin and an end isocyanate content urethane UREPO reamer with water, adding a dispersant and the organic solvent if needed, and agitating and distributing (or further reaction). In addition, of course, the grade of churning may adjust the particle size of an urethane system resin (a particle diameter is explained in full detail behind). Moreover, if various kinds of above-mentioned conditions (particle size is included) are fulfilled, the drainage system emulsion of an urethane system resin can also use suitably various kinds of commercial elegance (the so-called polyurethane drainage system dispersion paint). Specifically, the VONDIC series by Dainippon Ink & Chemicals, Inc. is mentioned as one example.

[0023] The resin-treatment steel plate of this invention has the resin coat which consists of such an urethane system resin and a polyethylene wax whose Ts (softening temperature) is 90-130 degrees C. Although average molecular weight of polyethylene is generally crystalline thermoplastics of hundreds - a-1 million number, the molecular weight of a polyethylene wax is a thing to several 1000. Therefore, cohesive force is low, and since the breaking energy is small and self breaks easily, it has lubricity. Moreover, it is representation, although it has the flexible property in ordinary temperature and the critical field tension has the lubrication action which about 30 dyne/cm and whose surface energy are lows, and was very excellent from wettability and adhesion being low, since the Tg is -100 degree C.

[0024] In this invention, the polyethylene wax whose Ts is 90 degrees C - 130 degrees C among such polyethylene waxes is used. the case where Ts of a polyethylene wax is less than 90 degrees C -- the bottom of press environment -- a coat -- flexible -- becoming -- passing -- metal mold -- the increase in coefficient of friction by the metal-to-metal contact between /materials arises On the contrary, if Ts exceeds 130 degrees C, the increase in coefficient of friction by destruction or the increase in a deformation resistance will start. That is, when Ts exceeds the above-mentioned range, even if it is which case, press-working-of-sheet-metal nature falls. In addition, the range of Ts of a polyethylene wax is 100 degrees C - 120 degrees C preferably.

[0025] in this invention, the above-mentioned conditions are fulfilled as a polyethylene wax -- well-known and various use of a commercial thing are possible inside -- desirable -- average molecular weight -- 3000-9000 -- the thing of 5000-8000 is used more preferably Moreover, as for such a polyethylene wax, in this invention, using as a drainage system emulsion is desirable. Various use is possible for well-known methods, such as the method of especially limitation not having in the manufacture method of the drainage system emulsion of a polyethylene wax, mixing a polyethylene wax and water, adding a dispersant and the organic solvent if needed, and agitating and distributing. In addition, it is the same as that of an urethane system resin which may adjust the particle size of a polyethylene wax according to the grade of churning (a particle diameter is explained in full detail behind). Moreover, if various kinds of above-mentioned conditions (particle size is included) are fulfilled as a drainage system emulsion of a polyethylene wax, various kinds of commercial elegance can also be used suitably. Specifically, the CHEMIPEARL series by Mitsui Petrochemical Industries, Ltd. is mentioned as one example.

[0026] In this invention, preferably, it is the drainage system emulsion coating of these urethane system resins and a polyethylene wax, and an urethane system resin and a polyethylene wax use that whose particle diameter is 0.01 micrometers - 0.2 micrometers. The amount of transparency of salt water becomes small, and the rust prevention nature in non-oiling tends to improve, so that the film formation nature of a paint film increases in the case of a drainage system emulsion paint film. Although the method of making a particle diameter small is effective in order to raise film formation nature by fixed composition, it is necessary for that to raise the hydrophilic-group density in a resin, or to make the addition of a film formation assistant increase. However, by this method, even if a particle diameter becomes small and film formation nature improves, there is a limitation in improvement in the rust prevention nature in non-oiling, and since it is the hydrophilic property of a resin, the fall of the adhesion and secondary deck-watertight-luminaire adhesion of a finishing paint film is also seen.

[0027] The range of a suitable particle diameter is determined from the limitation of these properties. That is, when the particle diameter of the urethane system resin distributed by drainage system emulsion coating and a polyethylene wax is less than 0.01 micrometers, it is inferior to the rust prevention nature in non-oiling, finishing paint film adhesion, or secondary deck-watertight-luminaire adhesion with the conditions of baking etc., and when a particle diameter is 0.2-micrometer **, similarly, film formation nature falls and it is inferior to non-oiling rust prevention nature. In addition, the particle diameter in the drainage system emulsion coating used by this invention is 0.05 micrometers - 0.15 micrometers preferably.

[0028] For the resin-treatment steel plate of this invention, the coating weight after dryness formed from such an urethane system resin and a polyethylene wax is 0.5 g/m² - 3.0 g/m². The solid-content ratio of an urethane system resin / polyethylene wax has the lubricating-treatment coat of 97 / 3 - 80/20. The coating weight of this lubricous resin coat is 0.5 g/m². A coat cannot be finishing wearing a steel plate front face as it is the following, coefficient of friction becomes high, consequently non-oiling press-working-of-sheet-metal nature falls. Moreover, for a low reason, surface coverage of the amount [of contact] to the steel plate of salt water increases, and non-oiling rust prevention nature is inferior. On the contrary, coating weight is 3.0g/m². If it exceeds, although non-oiling press-working-of-sheet-metal nature and non-oiling rust prevention nature will improve, it becomes thickness to the extent that surface coverage is high and coat thickness is moreover hard to be destroyed at the time of welding, an energizing point becomes that there is nothing, and poor weldability is started. in addition, the resin-treatment steel plate of this invention -- setting -- the coating weight of a lubricous resin coat -- desirable -- 0.8 g/m² - 2.5 g/m² it is .

[0029] Moreover, the solid-content ratios of the urethane system resin / polyethylene wax in this lubricous resin coat (the aforementioned drainage system emulsion coating) are 97 / 3 - 80/20 in a weight ratio. This limit is mainly concerned with non-oiling press-working-of-sheet-metal nature. That is, the degree of hardness of a resin is farther [than a wax] high, and it has the role which prevents contact to metal mold and a steel plate. On the other hand, the wax has the role which makes low the workload at the time of metal mold sliding. Therefore, if the ratio of an urethane system resin / polyethylene wax exceeds 97/3, lubricity will fall too much and good press-working-of-sheet-metal nature will not be obtained. On the contrary, by less than 80/20, while ratio contact of metal mold and a steel plate increases and lubricity, i.e., press-working-of-sheet-metal nature, falls, since a wax is non-polarity, it is inferior to adhesion with a finishing paint film, or secondary deck-watertight-luminaire adhesion.

[0030] this invention -- a resin treatment -- a steel plate -- setting -- being such -- lubricous -- a resin -- a coat -- five -- 15 -- a second -- the back -- attainment -- board temperature -- 50 -- 70 -- degree C -- becoming -- as -- conditions -- pretreatment -- carrying out -- without -- printing -- ***** -- carrying out -- moreover -- obtaining -- having had -- a coat -- the following -- [-- A --] -- a formula -- giving a definition -- having had -- film formation -- a rate -- 70

Rate [of a lubricating-treatment coat] of film formation (%) = [(particle number of particle number-printing paint film of air-drying coat)particle number of /air-drying coat] x100 [A] Formula. [0031] In addition, in the above-mentioned [A] formula, an air-drying coat is a coat which left for 24 hours and was formed at the room temperature, after applying a paint. On the other hand, a printing paint film is a coat formed by printing from which the attainment board temperature of 10 seconds after becomes 50 degrees C. furthermore, 1micrometex of the urethane system resin particle which applies and carries out the brittle fracture of the force to the particle number in both coats (paint film) rapidly after cooling a resin-treatment steel plate by liquid nitrogen, observes the lubricous coat fracture surface on the front face of a steel plate by 10,000 times with an electron microscope, and can be checked clearly, and a polyethylene wax particle -- it is a number per micrometer (both total number)

[0032] That is, the rate of film formation shows the rate of weld of resin particles of perfection, i.e., the degree of a coat, and the rate of film formation of a lubricous resin coat is made into 70% or more in the resin-treatment steel plate of this invention. When film formation nature is less than 70%, a micro coat defect generates so much, the permeability of the water which serves as a corrosion reason through this, or ion becomes high, and a result inferior to non-oiling rust prevention nature is brought. Moreover, as for the rate of film formation, in this invention, considering as 90% or more is desirable. In addition, a particle diameter of a resin (wax), an amount of a film formation agent, etc. which are contained in a paint can adjust the rate of film formation of a lubricous resin coat.

[0033] It burns without pretreating preferably on conditions from which the attainment board temperature of 5 - 15 seconds after becomes 50-70 degrees C, in case the lubricous resin coat with which it is satisfied of the above-mentioned terms and conditions in this invention is formed. As mentioned above, if printing is fully performed at an elevated temperature over many hours using the paint of a general organic-solvent system, it is easy to discover many properties, such as primary rust prevention nature and press-working-of-sheet-metal nature. However, in order that the method of painting hot-rolling and a cold rolled sheet steel with another line may cause the cost rise of a resin treatment, it wants not to pretreat in the very short space by the side of CAL appearance, and to perform paint and printing by the case of a cold rolled sheet steel, immediately after a pickling process, by the case of a hot rolled sheet steel. And since he wants to make a paint facility and incidental facilities cheap, it is the baking furnace of about [5-10m] short length, and it is necessary to make the low steam of energy cost into a heat source, and a cheap non-explosion protection type printing furnace needs to perform paint printing.

[0034] Therefore, after filling the above-mentioned demand with conditions from which the attainment board temperature of 5 - 15 seconds after becomes 50-70 degrees C by performing printing, without pretreating, the lubricous resin coat which fulfills the aforementioned terms and conditions can be formed, and a desirable result is obtained. A good coat can be easily formed according to this printing condition by using the aforementioned drainage system emulsion coating especially. When attainment board temperature uses an about [5-10m] short baking furnace at less than 50 degrees C, water and other assistants may remain in a coat, rust prevention nature, finishing paint film adhesion, and poor secondary deck-watertight-luminaire adhesion may be started, and paint film formation is also poor and also has press-working-of-sheet-metal nature also with a bird clapper as it is poor. Although printing which exceeds 70 degrees C and, on the other hand, satisfies many above-mentioned demands then is possible, using a steam as a heat source causes the cost rise of a resin treatment, and becoming difficult etc. has it at this point. [disadvantageous]

[0035] Hereafter, the manufacture method of the lubricous resin steel plate of this invention is explained. First, the drainage system emulsion of the above-mentioned urethane system resin and the drainage system emulsion of a polyethylene wax are mixed, and the drainage system emulsion coating from which the solid-content ratio of an urethane system resin / polyethylene wax is set to 97 / 3 - 80/20 is prepared. In addition, limitation is not carried out to manufacture of this drainage system emulsion coating mixing a urethane-resin emulsion and a polyethylene wax emulsion, but drainage system emulsion coating may be prepared by throwing in an urethane system resin and a polyethylene wax (simultaneous or one by one), and agitating in the water used as a dispersion medium, so that each above-mentioned conditions may be fulfilled.

[0036] To one side or both sides of a cold rolled sheet steel which were discharged from CAL which also spreads the hot rolled sheet steel which ended pickling, by known methods, such as a bar coating machine, a roll coater, a curtain flow coater, a SUPU 4-coating machine, or spray painting The aforementioned drainage system emulsion coating is applied. Or after a steel plate is immersed into the drainage system emulsion coating mentioned above, it extracts to the specified quantity by blasting of a roll or air, and the coating weight after dryness is 0.5g/m² - 3.0 g/m². A coat of the drainage system emulsion

coating of the specified quantity which serves as a range is formed. Subsequently, by printing this on the conditions from which the post-attainment board temperature printed for 5 - 15 seconds becomes 50-70 degrees C by the air-heating furnace or induction heating apparatus, a non-alkali removing-of-coating type resin coat is formed in one side or both sides of a steel plate, and the resin-treatment steel plate of this invention is obtained.

[0037]

[Example] Hereafter, the concrete example of this invention is given and this invention is explained more to a detail. The bar coating-machine paint of the various paints as shown in following Table 1 - 4 was carried out, and it adjusted to predetermined coating weight, on the front face of the steel plate which degreased the front face, heating baking finish was performed using the hot air drying equipment so that it might become predetermined printing conditions (board temperature), and various kinds of test pieces were produced on it. In addition, the paint mixed and prepared the drainage system emulsion VONDIC series by Dainippon Ink & Chemicals, Inc.) of an urethane system resin, and the drainage system emulsion CHEMIPEARL series by Mitsui Petrochemical Industries, Ltd.) of a polyethylene wax, and adjusted Tg, respectively by the monomer component contained in a resin by the kind and addition of a surfactant in a particle diameter. Moreover, PMT of the printing conditions in Tables 1-4 is attainment board temperature (Peak Metal Temperature).

[0038]

[Table 1]

表 1 (発明例)

No.	鋼板	ウレタン系樹脂			ポリエチレンワックス		樹脂／ ポリエチレンワックス	造膜率 (%)	皮膜 付着量 (g/m ²)	焼付条件
		粒子径 (μm)	Tg (°C)	酸価 (KOHmg/g)	粒子径 (μm)	Ts (°C)				
発明鋼板1	熱延板	0.01	70	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板2	熱延板	0.1	70	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板3	熱延板	0.2	70	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板4	熱延板	0.1	40	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板5	熱延板	0.1	100	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板6	熱延板	0.1	70	10	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板7	熱延板	0.1	70	50	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板8	熱延板	0.1	70	30	0.01	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板9	熱延板	0.1	70	30	0.2	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板10	熱延板	0.1	70	30	0.1	90	90/10	90	1.0	10秒PMT60 °C
発明鋼板11	熱延板	0.1	70	30	0.1	130	90/10	90	1.0	10秒PMT60 °C

[0039]

[Table 2]

表 2 (実施例)

No.	鋼板	樹脂			ポリエチレンワックス		樹脂／ ポリエチレンワックス	造膜率 (%)	皮膜 付着量 (g/m ²)	焼付条件
		粒子径 (μm)	Tg (°C)	酸価 (KOHmg/g)	粒子径 (μm)	Ts (°C)				
発明鋼板12	熱延板	0.1	70	30	0.1	110	97/3	90	1.0	10秒PMT60 °C
発明鋼板13	熱延板	0.1	70	30	0.1	110	80/20	90	1.0	10秒PMT60 °C
発明鋼板14	熱延板	0.1	70	30	0.1	110	90/10	70	1.0	10秒PMT60 °C
発明鋼板15	熱延板	0.1	70	30	0.1	110	90/10	100	1.0	10秒PMT60 °C
発明鋼板16	熱延板	0.1	70	30	0.1	110	90/10	90	0.5	10秒PMT60 °C
発明鋼板17	熱延板	0.1	70	30	0.1	110	90/10	90	3.0	10秒PMT60 °C
発明鋼板18	冷延板	0.1	70	30	0.1	110	90/10	90	1.0	10秒PMT60 °C

[0040]

[Table 3]

表 3 (比較例)

No.	鋼 板	樹 脂			ポリエチレン ワックス		樹脂/ ポリエチ レンワッ クス	造膜率 (%)	皮 膜 付着量 (g/m ²)	焼 付 条 件
		粒子径 (μm)	Tg (°C)	酸 価 (KOHmg/g)	粒子径 (μm)	Ts (°C)				
比較鋼板 1	熱延板	0.005	70	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板 2	熱延板	0.3	70	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板 3	熱延板	0.1	30	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板 4	熱延板	0.1	110	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板 5	熱延板	0.1	70	5	0.1	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板 6	熱延板	0.1	70	60	0.1	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板 7	熱延板	0.1	70	30	0.005	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板 8	熱延板	0.1	70	30	0.3	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板 9	熱延板	0.1	70	30	0.1	70	90/10	90	1.0	10秒PMT60 °C
比較鋼板 10	熱延板	0.1	70	30	0.1	140	90/10	90	1.0	10秒PMT60 °C
比較鋼板 11	熱延板	0.1	70	30	0.1	110	98/2	90	1.0	10秒PMT60 °C

[0041]

[Table 4]

表 4 (比較例)

No.	鋼 板	樹 脂			ポリエチレン ワックス		樹脂/ ポリエチ レンワッ クス	造膜率 (%)	皮 膜 付着量 (g/m ²)	焼 付 条 件
		粒子径 (μm)	Tg (°C)	酸 価 (KOHmg/g)	粒子径 (μm)	Ts (°C)				
比較鋼板 12	熱延板	0.1	70	30	0.1	110	70/30	90	1.0	10秒PMT60 °C
比較鋼板 13	熱延板	0.1	70	30	0.1	110	90/10	60	1.0	10秒PMT60 °C
比較鋼板 14	熱延板	0.1	70	30	0.1	110	90/10	90	0.3	10秒PMT60 °C
比較鋼板 15	熱延板	0.1	70	30	0.1	110	90/10	90	4.0	10秒PMT60 °C

[0042] About each obtained test piece, the following method was followed, and non-oiling rust prevention nature, non-oiling press-working-of-sheet-metal nature, finishing paint film adhesion, secondary deck-watertight-luminaire adhesion, weldability, and removing-of-coating nature were measured and evaluated.

[0043] (1) They are after production and JIS in the size of 50x100mm about a non-oiling rust prevention nature test piece. Z The salt spray test was performed according to 2371, and it evaluated in time until rust is generated 5%.

[0044] (2) Visual evaluation estimated the appearance of the cup side-attachment-wall section when carrying out spinning, without carrying out oiling to a non-oiling press-working-of-sheet-metal nature test piece, and carrying out cup fabrication by the maximum blank holder load and 1t of blank holder loads when the ability finishing extracting, without fracturing a steel plate. The error criterion of spinning conditions and appearance viewing is as follows.

[Processing conditions]

diameter of punch: -- 33mmphi -- blank -- path:70mmphi working-speed: -- 60mm [/] second blank holder load: -- 1-9t (at however, the time of appearance evaluation of the cup side-attachment-wall section 1t operation)

[The appearance evaluation standard of the cup side-attachment-wall section]

O : -- almost -- galling-less O: -- some -- **with galling: -- a little -- gnawing -- many x: -- many [gnaw very much and]

[0045] (3) After performing electropainting to the piece of a finishing paint film adhesion test on the following conditions, the paint film survival rate in a squares tape friction test estimated.

[Electropainting conditions]

Processing liquid: Power top U-600 (Nippon Paint Co., Ltd. make)

bath **: -- 28-degree-C electrodeposition voltage: -- 250v printing condition: -- for [170 degree-Cx] 20 minutes [0046] (4)

The squares tape friction test was performed to 40-degree C pure water after being 120-hour immersed, and the survival rate of an electrodeposited paint film estimated the electropainting steel plate produced under the conditions of the secondary deck-watertight-luminaire adhesion above (3).

[0047] (5) Using the weldability spot welder, on condition that the following, spot welding was continuously performed using the electrode of CF type 5.0mmphi, the number of RBIs when the diameter of a nugget becomes under 5 roott was defined as

the number of continuation RBIs, and this numeric value estimated.

[Spot welding conditions]

welding-pressure: -- 200kgf squeeze-time: -- 50cycle resistance-welding-time: -- 8cycle holding-time: -- 30cycle [0048] (6)

After carrying out spray degreasing (40 degrees C of bath temperature, spray ** 0.8 kg/cm², spray time 10 seconds) of the removing-of-coating nature paint steel plate with an alkali solution ([by Nihon Parkerizing Co., Ltd.] fine cleaner L3020 system), it carried out being immersed (3% of copper-sulfate concentration, 25 degrees C of bath temperature, immersing time 40 seconds) to copper-sulfate solution, the copper count was measured by fluorescence x line measurement, and it asked for the rate of removing of coating (%) from the following formula.

The result beyond [in a copper count / with the material in the case of a rate (%) of removing of coating = paint steel plate] copper count x100 is shown in following Table 5 and 6.

[0049]

[Table 5]

表 5 (発明例)

	無塗油 防錆性 (時間)	無塗油 加工性		上塗り 塗膜 密着性 (%)	耐水 密着性 (%)	溶接性 (打点)	脱膜率 (%)
		しわ押さえ 荷重(t)	外観 評価				
発明鋼板 1	3.5	3	◎	90	90	2000	5
発明鋼板 2	4	3	◎	100	100	2000	0
発明鋼板 3	3.5	3	◎	100	100	2000	0
発明鋼板 4	4	2.5	○	100	100	2000	0
発明鋼板 5	4	2.5	○	100	100	2000	0
発明鋼板 6	3.5	3	◎	90	90	2000	0
発明鋼板 7	3.5	3	◎	100	100	2000	5
発明鋼板 8	4	3	◎	100	100	2000	0
発明鋼板 9	4	3	◎	100	100	2000	0
発明鋼板 10	4	2.5	○	100	100	2000	0
発明鋼板 11	4	2.5	○	100	100	2000	0
発明鋼板 12	4	2.5	○	100	100	2000	0
発明鋼板 13	4.5	2.5	○	100	100	2000	0
発明鋼板 14	3.5	3	◎	100	100	2000	0
発明鋼板 15	4	3	◎	100	100	2000	0
発明鋼板 16	4	2.5	◎	100	100	3000	0
発明鋼板 17	4	3	◎	100	100	1500	0
発明鋼板 18	4	3	◎	100	100	2000	0

[0050]

[Table 6]

表 6 (比較例)

	無塗油 防錆性 (時間)	無塗油 加工 しわ押さえ 荷重(t)		上塗り 塗膜 密着性 (%)	耐水 密着性 (%)	溶接性 (打点)	脱膜率 (%)
		塗 工 性	外観 評価				
比較鋼板 1	1.5	3	◎	50	50	2000	0
比較鋼板 2	2	3	◎	100	100	2000	0
比較鋼板 3	4	1	△	100	100	2000	0
比較鋼板 4	4	1	△	100	100	2000	0
比較鋼板 5	4	3	◎	50	50	2000	0
比較鋼板 6	4	3	◎	100	100	2000	40
比較鋼板 7	4	3	○	70	70	2000	0
比較鋼板 8	2	3	◎	70	70	2000	0
比較鋼板 9	4	1	△	100	100	2000	0
比較鋼板 10	4	1	△	100	100	2000	0
比較鋼板 11	4	1	×	100	100	2000	0
比較鋼板 12	4	1	△	100	100	2000	0
比較鋼板 13	1.5	3	◎	100	100	2000	0
比較鋼板 14	1.5	1	×	100	100	2000	0
比較鋼板 15	4.5	3.5	◎	100	100	500	0

[0051] In addition, the comparison steel plates 7 and 8 have all brought a result which membrane formation is not suitably performed, consequently is inferior to non-oiling rust prevention nature, top coat adhesion, secondary deck-watertight-luminaire adhesion, etc. on this condition at the comparison steel plates 1 and 2 and the row. From the above result, it is a book.

[0052]

[Effect of the Invention] As mentioned above, as explained in detail, it is the non-alkali removing-of-coating type lubricous resin-treatment steel plate of this invention. even if have the primary rust prevention nature which was excellent even if it did not apply a slushing oil to the front face, and it has press-working-of-sheet-metal nature even if it does not apply a press oil, and it excels also in weldability and it moreover passes through an alkaline-degreasing process after that -- removing of coating -- not carrying out -- this -- with, even if it does not generate a phosphoric acid zinc coat, it has sufficient finishing paint film adhesion and secondary deck-watertight-luminaire adhesion And since the non-alkali removing-of-coating type lubricous resin-treatment steel plate of this invention can be manufactured in the above low-temperature short-time painting processes, the productivity of the improvement in productive efficiency in a steel plate maker and a press-working-of-sheet-metal maker, an automaker, etc. and an effect greatest to laborsaving are demonstrated, and it is thought that it greatly contributes to development of industry.

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention belongs to the technical field of a resin-treatment steel plate. Since weldability at the time of being able to skip the alkaline-degreasing process currently carried out after the press, and this joining mold goods, since press working of sheet metal can be carried out more to a detail by non-oiling is not spoiled and it is moreover a non-alkali removing-of-coating type coat, Exist in the steel plate front face, without a resin-treatment coat dissolving, even if it passes through the oiling -> alkaline-degreasing process currently performed from the former, and adhere, and although there is nothing, chemical-conversion coats, such as phosphoric-acid zinc It has the adhesion and secondary deck-watertight-luminaire adhesion of finishing paint films, such as electropainting and electrostatic powder coating. Furthermore, it is related with hot-rolling which comes to have the non-alkali removing-of-coating type lubricous resin treatment excellent in non-oiling rust prevention nature, non-oiling press-working-of-sheet-metal nature, finishing paint film adhesion, secondary deck-watertight-luminaire adhesion, and weldability which is excellent also in the weldability at the time of joining a press-working-of-sheet-metal object or a cold rolled sheet steel, and its manufacture method.

[0002] If printing is fully performed at an elevated temperature over many hours using the paint of a general organic-solvent system, it is comparatively easy to discover many properties, such as primary rust prevention nature and press-working-of-sheet-metal nature. However, in order that the method of painting hot-rolling and a cold rolled sheet steel with another line may cause the manufacturing-cost rise of a resin-treatment steel plate, it wants not to pretreat in the very short space by the side of CAL (continuous-annealing line) appearance, and to perform paint and printing also by the case of a cold rolled sheet steel, immediately after a pickling process, by the case of a hot rolled sheet steel. And since he wants to make a paint facility and incidental facilities cheap, it is the baking furnace of about [5-10m] short length, and it is necessary to make the low steam of energy cost into a heat source, and a cheap non-explosion protection type printing furnace needs to perform paint printing. In order to fill the demand on such a production line, it is desirable to burn on conditions from which the attainment board temperature of 5 - 15 seconds after becomes 50-70 degrees C, without pretreating. Moreover, this invention realizes the lubricous resin-treatment steel plate with which the above-mentioned demand in a production line is given possible, and it is satisfied of the above-mentioned property by using predetermined drainage system emulsion coating.

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PRIOR ART

[Description of the Prior Art] Development of the lubricative resin steel plate with which it has the primary rust prevention nature which was excellent even if it did not apply a slushing oil to the front face, and it has press-working-of-sheet-metal nature even if it does not apply a press oil, it moreover excels also in weldability, removing of coating is not further carried out even if it passes through an alkaline-degreasing process after that, with a phosphoric acid zinc coat does not generate, but ** also has sufficient finishing paint film adhesion is demanded from the former. However, the present condition is that technology as shown below is proposed as similar technology which technology which solves such all properties simultaneously is not yet realized, but contains the part.

[0004] For example, water solubility and/or a water-dispersion resin are applied to a cold-rolled-sheet-steel front face, and the lubricating-treatment metal plate for press working of sheet metal which has the lubricous coat makes solid lubricant powdered, and applied and the non-dried coat front face was made to dry in ordinary temperature is indicated by JP,53-44468,A. According to this lubricating-treatment metal plate, although the press-working-of-sheet-metal nature and weldability in non-oiling are obtained, this coat system has alkali removing-of-coating nature, and its density of hydrophilic groups, such as a carboxyl group and a hydroxyl group, is high, it is rich in a hydrophilic property, and inferior to the rust prevention nature in non-oiling. Furthermore, two steps of manufacturing processes (a resin application -> solid lubricant application, dryness) are needed, and there is a difficulty also in respect of productivity.

[0005] Moreover, the rustproof lubricating-treatment steel plate which makes front faces, such as hot-rolling, cold-rolling, and a surface treated steel sheet, come to cover the constituent which consists of the alkaline-earth-metal salt of an oxidization wax, a rust-proofer, and a surfactant is indicated by JP,54-69662,A. Although press-working-of-sheet-metal nature is made to discover centering on an oxidization wax in the case of this rustproof lubricating-treatment steel plate, if it is not a mixed coat with a resin, a coat degree of hardness is too low, although it has lubricity, its ratio contact of metal mold and a material is large, and the press-working-of-sheet-metal nature in non-oiling is inferior. Moreover, although the oxidization wax and the surfactant are used together for the purpose of improvement in the lubricity of a coat, or emulsifiability, since it is not a non-alkali removing-of-coating type, it is inferior to the rust prevention nature in non-oiling. Furthermore, although the rustproof effect of a rust-proofer is accepted, since the rust prevention nature in non-oiling of the organic coat used as the base is very inferior, an effect is small by a setoff.

[0006] The high corrosion resistance surface treated steel sheet which made the coat containing an acrylic emulsion, a chromate, and a silica sol form in front faces, such as cold-rolling and a surface treated steel sheet, is indicated by JP,61-23767,A. In the case of this high corrosion resistance surface treated steel sheet, depending on the annealing conditions of coat formation, since there is very much water-soluble hexavalent chromium, the elution speed is too quick, and the rust prevention nature in non-oiling is poor. Moreover, it is industrially disadvantageous, if there are many chromium elution volumes to the inside of an alkaline-degreasing tub and they take the influence on circumference environment into consideration.

[0007] After forming a chromate film on the surface of a cold rolled sheet steel, the art which applies a water soluble resin or an emulsion is indicated by JP,62-77498,A. Moreover, in this art, a rust preventive pigment and a silica sol are added in the aforementioned water soluble resin if needed. However, in the case of this art, after preparing a chromate film, about a water soluble resin or an emulsion, coat formation is carried out and a difficulty is in productivity like an application and the example indicated by above-mentioned JP,53-44468,A. Moreover, although generation of the basic zinc chloride which suppresses corrosion is urged to addition of a silica sol and it brings about corrosion resistance improvement when making a zinc system plating steel plate into a base material, when making hot-rolling and a cold-rolled-sheet steel into a base material, it will reduce the rust prevention nature in non-oiling with the hydrophilic property of a silica sol conversely.

[0008] Furthermore, the steel plate which made press-forming nature, removing-of-coating nature, and rust prevention nature improve is indicated by JP,2-310384,A by carrying out application dryness of the water-soluble liquid which consists of a polyethylene oxide, a water-soluble rust-proofer, several sorts of other colloid, etc. on the surface of a steel plate. However, the rust prevention nature in non-oiling of this steel plate is not enough too, and, moreover, it does not have non-alkali removing-of-coating nature.

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EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, as explained in detail, it is the non-alkali removing-of-coating type lubricous resin-treatment steel plate of this invention. even if have the primary rust prevention nature which was excellent even if it did not apply a slushing oil to the front face, and it has press-working-of-sheet-metal nature even if it does not apply a press oil, and it excels also in weldability and it moreover passes through an alkaline-degreasing process after that -- removing of coating -- not carrying out -- this -- with, even if it does not generate a phosphoric acid zinc coat, it has sufficient finishing paint film adhesion and secondary deck-watertight-luminaire adhesion And since the non-alkali removing-of-coating type lubricous resin-treatment steel plate of this invention can be manufactured in the above low-temperature short-time painting processes, the productivity of the improvement in productive efficiency in a steel plate maker and a press-working-of-sheet-metal maker, an automaker, etc. and an effect greatest to laborsaving are demonstrated, and it is thought that it greatly contributes to development of industry.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The resin-treatment steel plate which the purpose of this invention has in solving the trouble of the aforementioned conventional technology, and fulfills many above-mentioned properties of all suitably, Namely, it has the primary rust prevention nature which was excellent even if it did not apply a slushing oil to the front face. And have the press-working-of-sheet-metal nature which was excellent even if it did not apply a press oil, and it excels also in weldability. and -- even if it passes through an alkaline-degreasing process after that -- removing of coating -- not carrying out -- this -- with, even if there is no phosphoric acid zinc coat, it is in offering the lubricous resin-treatment steel plate which has sufficient finishing paint film adhesion and secondary deck-watertight-luminaire adhesion

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MEANS

[Means for Solving the Problem] this invention person etc. repeated research wholeheartedly, in order to realize the resin-treatment steel plate with which are satisfied of many above-mentioned properties of all. Consequently, it found out that the view for having the rust prevention nature in non-oiling was important, and the following knowledge was acquired based on this also especially in inside.

[0011] First, in order to have the rust prevention nature in non-oiling, at the time of the wettability of a base material and a paint film, adhesion, especially lubrication, improvement in the adhesion force is effective and, for that, the method using the drainage system emulsion which consists of a urethane-resin system is effective. That is, it is because the high urethane bond of hydrogen bond ability has a big effect to raise the humid adhesion force. Moreover, it is also effective on the rustproof disposition in non-oiling to suppress transparency of salt water. The method of heightening the cohesive force between molecules for that purpose, and using the above-mentioned urethane bond also from this viewpoint is effective. Furthermore, rust prevention nature improves, so that the rate of film formation which is later mentioned also by the coat of the same composition in addition to both the aforementioned knowledge is high. The technique of making small the particle diameter of selection of printing conditions, a resin, or a wax emulsion for that purpose is also effective.

[0012] this invention is accomplished based on the above-mentioned knowledge. the acid number at 40 degrees C - 100 degrees C to one side or both sides of hot-rolling or a cold rolled sheet steel The urethane system resin of 10-50, [a glass transition point (Tg)] Softening temperature (Ts) consists of a polyethylene wax which is 90 degrees C - 130 degrees C. the solid-content ratio of an urethane system resin / polyethylene wax by the weight ratio by 97 / 3 - 80/20 It is the coat whose rate of film formation defined by the [following A] formula is 70% - 100% at coating weight 0.5 g/m² - 3.0 g/m² The non-alkali removing-of-coating type lubricous resin-treatment steel plate which it has is offered.

Rate [of a lubricating-treatment coat] of film formation (%) = [(particle number of particle number-printing paint film of air-drying coat)particle number of /air-drying coat] x100 [A] Formula (in the above-mentioned [A] formula with a particle number) 1micrometerx of the urethane system resin particle which applies and carries out the brittle fracture of the force rapidly after cooling a resin-treatment steel plate in liquid nitrogen, observes the lubricous coat fracture surface on the front face of a steel plate by 10,000 times with an electron microscope, and can be checked clearly, and a polyethylene wax particle -- it is a number per micrometer

[0013] Moreover, the manufacture method of this invention is the manufacture method of the non-alkali removing-of-coating type lubricous resin-treatment steel plate of the aforementioned this invention. The acid number at 40 degrees C - 100 degrees C by 0.01 micrometers - 0.2 micrometers The drainage system emulsion of the urethane system resin of 10-50, [a particle diameter] [a glass transition point (Tg)] By 0.01 micrometers - 0.2 micrometers, a particle diameter applies the drainage system emulsion coating which comes to mix the drainage system emulsion of the polyethylene wax whose softening temperature (Ts) is 90 degrees C - 130 degrees C, and offers the manufacture method of the non-alkali removing-of-coating type lubricous resin-treatment steel plate to print.

[0014] furthermore, another mode of this invention -- one side or both sides of hot-rolling or a cold rolled sheet steel -- the acid number with the drainage system emulsion of the urethane system resin of 10-50 at 40 degrees C - 100 degrees C by 0.01 micrometers - 0.2 micrometers [a particle diameter] [a glass transition point (Tg)] A particle diameter applies the drainage system emulsion coating which comes to mix the drainage system emulsion of the polyethylene wax whose softening temperature (Ts) is 90 degrees C - 130 degrees C by 0.01 micrometers - 0.2 micrometers. the coating weight which it comes to print -- 0.5 g/m² - 3.0 g/m² The non-alkali removing-of-coating type lubricous resin-treatment steel plate which has the lubricating-treatment coat whose rate of film formation as which the solid-content ratio of an urethane system resin / polyethylene wax was defined by the [following A] formula by the weight ratio 97 / 3 - 80/20 is 70% - 100% is offered.

Rate [of a lubricating-treatment coat] of film formation (%) = [(particle number of particle number-printing paint film of air-drying coat)particle number of /air-drying coat] x100 [A] Formula (in the above-mentioned [A] formula with a particle number) 1micrometerx of the urethane system resin particle which applies and carries out the brittle fracture of the force rapidly after cooling a resin-treatment steel plate in liquid nitrogen, observes the lubricous coat fracture surface on the front face of a steel plate by 10,000 times with an electron microscope, and can be checked clearly, and a polyethylene wax particle -- it is a number per micrometer

[0015]

[Embodiments of the Invention] Hereafter, the non-alkali removing-of-coating type lubricous resin-treatment steel plate (it considers as a resin-treatment steel plate hereafter) of this invention is explained in detail.

[0016] As a base material of the resin-treatment steel plate of this invention, various use of a general hot rolled sheet steel and a general cold rolled sheet steel is possible. However, the property level of press-working-of-sheet-metal nature or weldability mentioned later cannot be overemphasized by changing with steel plate thickness, the mechanical properties of a steel plate, etc.

[0017] The resin-treatment steel plate of this invention uses for one side or both sides of these steel plates the drainage system emulsion which T_g is 40 degrees C - 100 degrees C, and the lubricous resin coat which the acid number becomes from the urethane system resin of 10-50 and the polyethylene wax whose T_s is 90 degrees C - 130 degrees C is formed, and comes to mix the drainage system emulsion of an urethane system resin, and the drainage system emulsion of a polyethylene system wax preferably.

[0018] In the resin-treatment steel plate of this invention, the reason using an urethane system resin is for raising the rust prevention nature in non-oiling. As mentioned above, in order to raise rust prevention nature, improvement in the adhesion force is effective at the time of the wettability of a base material and a paint film and adhesion, especially humidity. Since it has an effect with big having the high urethane bond of hydrogen bond capacity for raising the humid adhesion force, the resin of an urethane system is used in this invention. Moreover, it is also effective to suppress transparency of salt water and, for that, it is necessary to heighten the cohesive force between molecules. It is effective like the above also from this viewpoint to use a urethane bond.

[0019] In this invention, the urethane system resin whose T_g (glass transition point) is 40 degrees C - 100 degrees C is used. In case continuation press working of sheet metal of the steel plate is carried out by non-oiling, the temperature up of the metal mold is carried out by frictional heating with metal mold and a steel plate, or plastic deformation generation of heat of a steel plate. Here, although this exoergic temperature has various possibility according to press conditions, if the range of 40 degrees C - 100 degrees C is considered on the average, it will be thought that it can respond mostly. If this thing is taken into consideration, 40 degrees C - 100 degrees C, then good press-working-of-sheet-metal nature can be obtained for T_g of an urethane system resin. that is, the metal mold according [when T_g is less than 40 degrees C, under press environment, a coat becomes soft too much, and] to deformation and ablation of a coat -- the rate of metal-to-metal contact between /steel plates increases, coefficient of friction rises, and press-working-of-sheet-metal nature falls On the other hand, in 100-degree-C **, the flexibility of the resin under press environment runs short, ablation of a coat etc. becomes intense too, and the same problem as the above occurs. In addition, the range of T_g of an urethane system resin is 60 degrees C - 90 degrees C preferably.

[0020] Moreover, in this invention, the acid number (mg of KOH required to neutralize the free fatty acid contained in 1g of resins number) uses the urethane system resin of 10-50. The acid number and alkali removing-of-coating nature are fundamentally in direct proportion. Therefore, when the acid number is less than ten, the hydrophilic property of an urethane system resin falls, even if it uses together and carries out moisture powder of the surfactant, sufficient distribution cannot be performed, but the particle diameter of a resin changes too much greatly, or the fall of the adhesion and secondary deck-watertight-luminaire adhesion of a finishing paint film occurs for the bleeding to the front face of a surfactant. On the contrary, in order to carry out removing of coating when alkali removing-of-coating nature becomes high, and the acid number exceeds 50 so that the acid number became high, and it passes through an alkaline-degreasing process, even if it is the case where it passes through what manufacturing process, the purpose of this invention of realizing the adhesion and secondary deck-watertight-luminaire adhesion of a finishing paint film which were excellent without adhesion of a chemical-conversion coat cannot be attained, but moreover, the hydrophilic property of a coat is too high and the fall of non-oiling rust prevention nature is also seen. In addition, the acid numbers of a urethane resin are 20-40 preferably.

[0021] in this invention, conditions, such as Above T_g and the acid number, are fulfilled as an urethane system resin -- well-known and various use of a commercial thing are possible Specifically, it is HYDRAN HW-311 by Dainippon Ink & Chemicals, Inc. as one example. Various kinds of things of HW-317 grade are mentioned.

[0022] In this invention, the drainage system emulsion of such an urethane system resin is used preferably. Various use is possible for well-known methods, such as the method of especially limitation not having in the manufacture method of the drainage system emulsion of an urethane system resin, mixing a urethane resin and an end isocyanate content urethane UREPO reamer with water, adding a dispersant and the organic solvent if needed, and agitating and distributing (or further reaction). In addition, of course, the grade of churning may adjust the particle size of an urethane system resin (a particle diameter is explained in full detail behind). Moreover, if various kinds of above-mentioned conditions (particle size is included) are fulfilled, the drainage system emulsion of an urethane system resin can also use suitably various kinds of commercial elegance (the so-called polyurethane drainage system dispersion paint). Specifically, the VONDIC series by Dainippon Ink & Chemicals, Inc. is mentioned as one example.

[0023] The resin-treatment steel plate of this invention has the resin coat which consists of such an urethane system resin and a polyethylene wax whose T_s (softening temperature) is 90-130 degrees C. Although average molecular weight of polyethylene is generally crystalline thermoplastics of hundreds - a-1 million number, the molecular weight of a polyethylene wax is a thing to several 1000. Therefore, cohesive force is low, and since the breaking energy is small and self breaks easily, it has lubricity. Moreover, it is representation, although it has the flexible property in ordinary temperature and the critical field tension has the lubrication action which about 30 dyne/cm and whose surface energy are lows, and was very excellent from wettability and adhesion being low, since the T_g is -100 degree C.

[0024] In this invention, the polyethylene wax whose T_s is 90 degrees C - 130 degrees C among such polyethylene waxes is used. the case where T_s of a polyethylene wax is less than 90 degrees C -- the bottom of press environment -- a coat -- flexible

-- becoming -- passing -- metal mold -- the increase in coefficient of friction by the metal-to-metal contact between /materials arises On the contrary, if Ts exceeds 130 degrees C, the increase in coefficient of friction by destruction or the increase in a deformation resistance will start. That is, when Ts exceeds the above-mentioned range, even if it is which case, press-working-of-sheet-metal nature falls. In addition, the range of Ts of a polyethylene wax is 100 degrees C - 120 degrees C preferably.

[0025] in this invention, the above-mentioned conditions are fulfilled as a polyethylene wax -- well-known and various use of a commercial thing are possible inside -- desirable -- average molecular weight -- 3000-9000 -- the thing of 5000-8000 is used more preferably Moreover, as for such a polyethylene wax, in this invention, using as a drainage system emulsion is desirable. Various use is possible for well-known methods, such as the method of especially limitation not having in the manufacture method of the drainage system emulsion of a polyethylene wax, mixing a polyethylene wax and water, adding a dispersant and the organic solvent if needed, and agitating and distributing. In addition, it is the same as that of an urethane system resin which may adjust the particle size of a polyethylene wax according to the grade of churning (a particle diameter is explained in full detail behind). Moreover, if various kinds of above-mentioned conditions (particle size is included) are fulfilled as a drainage system emulsion of a polyethylene wax, various kinds of commercial elegance can also be used suitably. Specifically, the CHEMIPEARL series by Mitsui Petrochemical Industries, Ltd. is mentioned as one example.

[0026] In this invention, preferably, it is the drainage system emulsion coating of these urethane system resins and a polyethylene wax, and an urethane system resin and a polyethylene wax use that whose particle diameter is 0.01 micrometers - 0.2 micrometers. The amount of transparency of salt water becomes small, and the rust prevention nature in non-oiling tends to improve, so that the film formation nature of a paint film increases in the case of a drainage system emulsion paint film. Although the method of making a particle diameter small is effective in order to raise film formation nature by fixed composition, it is necessary for that to raise the hydrophilic-group density in a resin, or to make the addition of a film formation assistant increase. However, by this method, even if a particle diameter becomes small and film formation nature improves, there is a limitation in improvement in the rust prevention nature in non-oiling, and since it is the hydrophilic property of a resin, the fall of the adhesion and secondary deck-watertight-luminaire adhesion of a finishing paint film is also seen.

[0027] The range of a suitable particle diameter is determined from the limitation of these properties. That is, when the particle diameter of the urethane system resin distributed by drainage system emulsion coating and a polyethylene wax is less than 0.01 micrometers, it is inferior to the rust prevention nature in non-oiling, finishing paint film adhesion, or secondary deck-watertight-luminaire adhesion with the conditions of baking etc., and when a particle diameter is 0.2-micrometer **, similarly, film formation nature falls and it is inferior to non-oiling rust prevention nature. In addition, the particle diameter in the drainage system emulsion coating used by this invention is 0.05 micrometers - 0.15 micrometers preferably.

[0028] For the resin-treatment steel plate of this invention, the coating weight after dryness formed from such an urethane system resin and a polyethylene wax is 0.5 g/m² - 3.0 g/m². The solid-content ratio of an urethane system resin / polyethylene wax has the lubricating-treatment coat of 97 / 3 - 80/20. The coating weight of this lubricous resin coat is 0.5 g/m². A coat cannot be finishing wearing a steel plate front face as it is the following, coefficient of friction becomes high, consequently non-oiling press-working-of-sheet-metal nature falls. Moreover, for a low reason, surface coverage of the amount [of contact] to the steel plate of salt water increases, and non-oiling rust prevention nature is inferior. On the contrary, coating weight is 3.0g/m². If it exceeds, although non-oiling press-working-of-sheet-metal nature and non-oiling rust prevention nature will improve, it becomes thickness to the extent that surface coverage is high and coat thickness is moreover hard to be destroyed at the time of welding, an energizing point becomes that there is nothing, and poor weldability is started. in addition, the resin-treatment steel plate of this invention -- setting -- the coating weight of a lubricous resin coat -- desirable -- 0.8 g/m² - 2.5 g/m² it is .

[0029] Moreover, the solid-content ratios of the urethane system resin / polyethylene wax in this lubricous resin coat (the aforementioned drainage system emulsion coating) are 97 / 3 - 80/20 in a weight ratio. This limit is mainly concerned with non-oiling press-working-of-sheet-metal nature. That is, the degree of hardness of a resin is farther [than a wax] high, and it has the role which prevents contact to metal mold and a steel plate. On the other hand, the wax has the role which makes low the workload at the time of metal mold sliding. Therefore, if the ratio of an urethane system resin / polyethylene wax exceeds 97/3, lubricity will fall too much and good press-working-of-sheet-metal nature will not be obtained. On the contrary, by less than 80/20, while ratio contact of metal mold and a steel plate increases and lubricity, i.e., press-working-of-sheet-metal nature, falls, since a wax is non-polarity, it is inferior to adhesion with a finishing paint film, or secondary deck-watertight-luminaire adhesion.

[0030] this invention -- a resin treatment -- a steel plate -- setting -- being such -- lubricous -- a resin -- a coat -- five -- -- 15 -- a second -- the back -- attainment -- board temperature -- 50 -- -- 70 -- degree C -- becoming -- as -- conditions -- pretreatment -- carrying out -- without -- printing -- ***** -- carrying out -- moreover -- obtaining -- having had -- a coat -- the following -- [- A -] -- a formula -- giving a definition -- having had -- film formation -- a rate -- 70

Rate [of a lubricating-treatment coat] of film formation (%) = [(particle number of particle number-printing paint film of air-drying coat)particle number of /air-drying coat] x100 [A] Formula. [0031] In addition, in the above-mentioned [A] formula, an air-drying coat is a coat which left for 24 hours and was formed at the room temperature, after applying a paint. On the other hand, a printing paint film is a coat formed by printing from which the attainment board temperature of 10 seconds after becomes 50 degrees C. furthermore, 1micrometerx of the urethane system resin particle which applies and carries out the brittle fracture of the force to the particle number in both coats (paint film) rapidly after cooling a

resin-treatment steel plate by liquid nitrogen, observes the lubricous coat fracture surface on the front face of a steel plate by 10,000 times with an electron microscope, and can be checked clearly, and a polyethylene wax particle -- it is a number per micrometer (both total number)

[0032] That is, the rate of film formation shows the rate of weld of resin particles of perfection, i.e., the degree of a coat, and the rate of film formation of a lubricous resin coat is made into 70% or more in the resin-treatment steel plate of this invention. When film formation nature is less than 70%, a micro coat defect generates so much, the permeability of the water which serves as a corrosion reason through this, or ion becomes high, and a result inferior to non-oiling rust prevention nature is brought. Moreover, as for the rate of film formation, in this invention, considering as 90% or more is desirable. In addition, a particle diameter of a resin (wax), an amount of a film formation agent, etc. which are contained in a paint can adjust the rate of film formation of a lubricous resin coat.

[0033] It burns without pretreating preferably on conditions from which the attainment board temperature of 5 - 15 seconds after becomes 50-70 degrees C, in case the lubricous resin coat with which it is satisfied of the above-mentioned terms and conditions in this invention is formed. As mentioned above, if printing is fully performed at an elevated temperature over many hours using the paint of a general organic-solvent system, it is easy to discover many properties, such as primary rust prevention nature and press-working-of-sheet-metal nature. However, in order that the method of painting hot-rolling and a cold rolled sheet steel with another line may cause the cost rise of a resin treatment, it wants not to pretreat in the very short space by the side of CAL appearance, and to perform paint and printing by the case of a cold rolled sheet steel, immediately after a pickling process, by the case of a hot rolled sheet steel. And since he wants to make a paint facility and incidental facilities cheap, it is the baking furnace of about [5-10m] short length, and it is necessary to make the low steam of energy cost into a heat source, and a cheap non-explosion protection type printing furnace needs to perform paint printing.

[0034] Therefore, after filling the above-mentioned demand with conditions from which the attainment board temperature of 5 - 15 seconds after becomes 50-70 degrees C by performing printing, without pretreating, the lubricous resin coat which fulfills the aforementioned terms and conditions can be formed, and a desirable result is obtained. A good coat can be easily formed according to this printing condition by using the aforementioned drainage system emulsion coating especially. When attainment board temperature uses an about [5-10m] short baking furnace at less than 50 degrees C, water and other assistants may remain in a coat, rust prevention nature, finishing paint film adhesion, and poor secondary deck-watertight-luminaire adhesion may be started, and paint film formation is also poor and also has press-working-of-sheet-metal nature also with a bird clapper as it is poor. Although printing which exceeds 70 degrees C and, on the other hand, satisfies many above-mentioned demands then is possible, using a steam as a heat source causes the cost rise of a resin treatment, and becoming difficult etc. has it at this point. [disadvantageous]

[0035] Hereafter, the manufacture method of the lubricous resin steel plate of this invention is explained. First, the drainage system emulsion of the above-mentioned urethane system resin and the drainage system emulsion of a polyethylene wax are mixed, and the drainage system emulsion coating from which the solid-content ratio of an urethane system resin / polyethylene wax is set to 97 / 3 - 80/20 is prepared. In addition, limitation is not carried out to manufacture of this drainage system emulsion coating mixing a urethane-resin emulsion and a polyethylene wax emulsion, but drainage system emulsion coating may be prepared by throwing in an urethane system resin and a polyethylene wax (simultaneous or one by one), and agitating in the water used as a dispersion medium, so that each above-mentioned conditions may be fulfilled.

[0036] To one side or both sides of a cold rolled sheet steel which were discharged from CAL which also spreads the hot rolled sheet steel which ended pickling, by known methods, such as a bar coating machine, a roll coater, a curtain flow coater, a SUPU 4-coating machine, or spray painting The aforementioned drainage system emulsion coating is applied. Or after a steel plate is immersed into the drainage system emulsion coating mentioned above, it extracts to the specified quantity by blasting of a roll or air, and the coating weight after dryness is 0.5g/m² - 3.0 g/m². A coat of the drainage system emulsion coating of the specified quantity which serves as a range is formed. Subsequently, by printing this on the conditions from which the post-attainment board temperature printed for 5 - 15 seconds becomes 50-70 degrees C by the air-heating furnace or induction heating apparatus, a non-alkali removing-of-coating type resin coat is formed in one side or both sides of a steel plate, and the resin-treatment steel plate of this invention is obtained.

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EXAMPLE

[Example] Hereafter, the concrete example of this invention is given and this invention is explained more to a detail. The bar coating-machine paint of the various paints as shown in following Table 1 - 4 was carried out, and it adjusted to predetermined coating weight, on the front face of the steel plate which degreased the front face, heating baking finish was performed using the hot air drying equipment so that it might become predetermined printing conditions (board temperature), and various kinds of test pieces were produced on it. In addition, the paint mixed and prepared the drainage system emulsion VONDIC series by Dainippon Ink & Chemicals, Inc.) of an urethane system resin, and the drainage system emulsion CHEMIPEARL series by Mitsui Petrochemical Industries, Ltd.) of a polyethylene wax, and adjusted Tg, respectively by the monomer component contained in a resin by the kind and addition of a surfactant in a particle diameter. Moreover, PMT of the printing conditions in Tables 1-4 is attainment board temperature (Peak Metal Temperature).

[0038]

[Table 1]

表 1 (発明例)

No.	鋼板	ウレタン系樹脂			ポリエチレンワックス		樹脂/ ポリエチレンワックス	造膜率 (%)	皮膜 付着量 (g/m ²)	焼付条件
		粒子径 (μ m)	Tg (°C)	酸価 (KOHmg/g)	粒子径 (μ m)	Ts (°C)				
発明鋼板1	熱延板	0.01	70	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板2	熱延板	0.1	70	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板3	熱延板	0.2	70	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板4	熱延板	0.1	40	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板5	熱延板	0.1	100	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板6	熱延板	0.1	70	10	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板7	熱延板	0.1	70	50	0.1	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板8	熱延板	0.1	70	30	0.01	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板9	熱延板	0.1	70	30	0.2	110	90/10	90	1.0	10秒PMT60 °C
発明鋼板10	熱延板	0.1	70	30	0.1	90	90/10	90	1.0	10秒PMT60 °C
発明鋼板11	熱延板	0.1	70	30	0.1	130	90/10	90	1.0	10秒PMT60 °C

[0039]

[Table 2]

表 2 (実施例)

No.	鋼板	樹脂			ポリエチレンワックス		樹脂／ ポリエチレンワックス	造膜率 (%)	皮膜 付着量 (g/m ²)	焼付条件
		粒子径 (μm)	T _g (°C)	酸価 (KOHmg/g)	粒子径 (μm)	T _s (°C)				
発明鋼板12	熱延板	0.1	70	30	0.1	110	97/3	90	1.0	10秒PMT60 °C
発明鋼板13	熱延板	0.1	70	30	0.1	110	80/20	90	1.0	10秒PMT60 °C
発明鋼板14	熱延板	0.1	70	30	0.1	110	90/10	70	1.0	10秒PMT60 °C
発明鋼板15	熱延板	0.1	70	30	0.1	110	90/10	100	1.0	10秒PMT60 °C
発明鋼板16	熱延板	0.1	70	30	0.1	110	90/10	90	0.5	10秒PMT60 °C
発明鋼板17	熱延板	0.1	70	30	0.1	110	90/10	90	3.0	10秒PMT60 °C
発明鋼板18	冷延板	0.1	70	30	0.1	110	90/10	90	1.0	10秒PMT60 °C

[0040]

[Table 3]

表 3 (比較例)

No.	鋼板	樹脂			ポリエチレンワックス		樹脂／ ポリエチレンワックス	造膜率 (%)	皮膜 付着量 (g/m ²)	焼付条件
		粒子径 (μm)	T _g (°C)	酸価 (KOHmg/g)	粒子径 (μm)	T _s (°C)				
比較鋼板1	熱延板	0.005	70	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板2	熱延板	0.3	70	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板3	熱延板	0.1	30	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板4	熱延板	0.1	110	30	0.1	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板5	熱延板	0.1	70	5	0.1	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板6	熱延板	0.1	70	60	0.1	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板7	熱延板	0.1	70	30	0.005	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板8	熱延板	0.1	70	30	0.3	110	90/10	90	1.0	10秒PMT60 °C
比較鋼板9	熱延板	0.1	70	30	0.1	70	90/10	90	1.0	10秒PMT60 °C
比較鋼板10	熱延板	0.1	70	30	0.1	140	90/10	90	1.0	10秒PMT60 °C
比較鋼板11	熱延板	0.1	70	30	0.1	110	98/2	90	1.0	10秒PMT60 °C

[0041]

[Table 4]

表 4 (比較例)

No.	鋼板	樹脂			ポリエチレンワックス		樹脂／ ポリエチレンワックス	造膜率 (%)	皮膜 付着量 (g/m ²)	焼付条件
		粒子径 (μm)	T _g (°C)	酸価 (KOHmg/g)	粒子径 (μm)	T _s (°C)				
比較鋼板12	熱延板	0.1	70	30	0.1	110	70/30	90	1.0	10秒PMT60 °C
比較鋼板13	熱延板	0.1	70	30	0.1	110	90/10	60	1.0	10秒PMT60 °C
比較鋼板14	熱延板	0.1	70	30	0.1	110	90/10	90	0.3	10秒PMT60 °C
比較鋼板15	熱延板	0.1	70	30	0.1	110	90/10	90	4.0	10秒PMT60 °C

[0042] About each obtained test piece, the following method was followed, and non-oiling rust prevention nature, non-oiling press-working-of-sheet-metal nature, finishing paint film adhesion, secondary deck-watertight-luminaire adhesion, weldability, and removing-of-coating nature were measured and evaluated.

[0043] (1) They are after production and JIS in the size of 50x100mm about a non-oiling rust prevention nature test piece. Z

The salt spray test was performed according to 2371, and it evaluated in time until rust is generated 5%.

[0044] (2) Visual evaluation estimated the appearance of the cup side-attachment-wall section when carrying out spinning, without carrying out oiling to a non-oiling press-working-of-sheet-metal nature test piece, and carrying out cup fabrication by the maximum blank holder load and 1t of blank holder loads when the ability finishing extracting, without fracturing a steel plate. The error criterion of spinning conditions and appearance viewing is as follows.

[Processing conditions]

diameter of punch: -- 33mmphi -- blank -- path:70mmphi working-speed: -- 60mm [/] second blank holder load: -- 1-9t (at however, the time of appearance evaluation of the cup side-attachment-wall section 1t operation)

[The appearance evaluation standard of the cup side-attachment-wall section]

O : -- almost -- galling-less O: -- some -- **with galling: -- a little -- gnawing -- many x: -- many [gnaw very much and]

[0045] (3) After performing electropainting to the piece of a finishing paint film adhesion test on the following conditions, the paint film survival rate in a squares tape friction test estimated.

[Electropainting conditions]

Processing liquid: Power top U-600 (Nippon Paint Co., Ltd. make)

bath **: -- 28-degree-C electrodeposition voltage: -- 250v printing condition: -- for [170 degree-Cx] 20 minutes [0046] (4)

The squares tape friction test was performed to 40-degree C pure water after being 120-hour immersed, and the survival rate of an electrodeposited paint film estimated the electropainting steel plate produced under the conditions of the secondary deck-watertight-luminaire adhesion above (3).

[0047] (5) Using the weldability spot welder, on condition that the following, spot welding was continuously performed using the electrode of CF type 5.0mmphi, the number of RBIs when the diameter of a nugget becomes under 5 roott was defined as the number of continuation RBIs, and this numeric value estimated.

[Spot welding conditions]

welding-pressure: -- 200kgf squeeze-time: -- 50cycle resistance-welding-time: -- 8cycle holding-time: -- 30cycle [0048] (6)

After carrying out spray degreasing (40 degrees C of bath temperature, spray ** 0.8 kg/cm², spray time 10 seconds) of the removing-of-coating nature paint steel plate with an alkali solution ([by Nihon Parkerizing Co., Ltd.] fine cleaner L3020 system), it carried out being immersed (3% of copper-sulfate concentration, 25 degrees C of bath temperature, immersing time 40 seconds) to copper-sulfate solution, the copper count was measured by fluorescence x line measurement, and it asked for the rate of removing of coating (%) from the following formula.

The result beyond [in a copper count / with the material in the case of a rate (%) of removing of coating = paint steel plate] copper count x100 is shown in following Table 5 and 6.

[0049]

[Table 5]

表 5 (発明例)

	無塗油 防錆性 (時間)	無塗油 加工性		上塗り 塗膜 密着性 (%)	耐水 密着性 (%)	溶接性 (打点)	脱膜率 (%)
		しわ押さえ 荷重(t)	外観 評価				
発明鋼板 1	3.5	3	◎	90	90	2000	5
発明鋼板 2	4	3	◎	100	100	2000	0
発明鋼板 3	3.5	3	◎	100	100	2000	0
発明鋼板 4	4	2.5	○	100	100	2000	0
発明鋼板 5	4	2.5	○	100	100	2000	0
発明鋼板 6	3.5	3	◎	90	90	2000	0
発明鋼板 7	3.5	3	◎	100	100	2000	5
発明鋼板 8	4	3	◎	100	100	2000	0
発明鋼板 9	4	3	◎	100	100	2000	0
発明鋼板 10	4	2.5	○	100	100	2000	0
発明鋼板 11	4	2.5	○	100	100	2000	0
発明鋼板 12	4	2.5	○	100	100	2000	0
発明鋼板 13	4.5	2.5	○	100	100	2000	0
発明鋼板 14	3.5	3	◎	100	100	2000	0
発明鋼板 15	4	3	◎	100	100	2000	0
発明鋼板 16	4	2.5	◎	100	100	3000	0
発明鋼板 17	4	3	◎	100	100	1500	0
発明鋼板 18	4	3	◎	100	100	2000	0

[0050]

[Table 6]

表 6 (比較例)

	無塗油 防錆性 (時間)	無塗油 加工性		上塗り 塗膜 密着性 (%)	耐水 密着性 (%)	溶接性 (打点)	脱膜率 (%)
		しわ押さえ 荷重(t)	外観 評価				
比較鋼板 1	1.5	3	◎	50	50	2000	0
比較鋼板 2	2	3	◎	100	100	2000	0
比較鋼板 3	4	1	△	100	100	2000	0
比較鋼板 4	4	1	△	100	100	2000	0
比較鋼板 5	4	3	◎	50	50	2000	0
比較鋼板 6	4	3	◎	100	100	2000	40
比較鋼板 7	4	3	○	70	70	2000	0
比較鋼板 8	2	3	◎	70	70	2000	0
比較鋼板 9	4	1	△	100	100	2000	0
比較鋼板 10	4	1	△	100	100	2000	0
比較鋼板 11	4	1	×	100	100	2000	0
比較鋼板 12	4	1	△	100	100	2000	0
比較鋼板 13	1.5	3	◎	100	100	2000	0
比較鋼板 14	1.5	1	×	100	100	2000	0
比較鋼板 15	4.5	3.5	◎	100	100	500	0

[0051] In addition, the comparison steel plates 7 and 8 have all brought a result which membrane formation is not suitably performed, consequently is inferior to non-oiling rust prevention nature, top coat adhesion, secondary deck-watertight-luminaire adhesion, etc. on this condition at the comparison steel plates 1 and 2 and the row. From the above result, it is a book.

[Translation done.]